

7 intermediate image from an object of a first plane surface;

8 and

9 a refraction type optical system for forming a second
10 image onto a second plane surface which is substantially
11 parallel to said first plane surface,

12 wherein, at least one of said first and second reflecting
13 surfaces forms said intermediate image at an off-axis
14 position, and said catadioptric type optical system is
15 disposed on a single linear optical axis.

REMARKS

Favorable reconsideration of this application, as amended, is respectfully requested,

Claims 1-16 have been replaced by new Claims 17-50, to advance the prosecution. The new claims clearly distinguish patentably from Shafer et al. ,relied upon in the rejection under 35 U.S.C. § 102(e), and Shafer et al in view of Official Notice relied upon in the rejection under 35 U.S.C. § 103(a).

New independent Claim 17 recites, inter alia, a first reflecting surface that has an aperture portion at an off-axis position. New independent Claims 29 and 42 recite, inter alia, light coming from a second reflecting surface passing a first reflecting surface off-axis thereof.

New independent Claim 50 recites, inter alia, that at least one of first and second reflecting surfaces forms an intermediate image at an off-axis position.

In connection with the foregoing recitations of the independent claims, see the off-axis intermediate image I1 in Figs. 2, 4, and 6, and see page 7 of the specification, lines 14-22.

Shafer et al. show on-axis apertures in Figs. 1-3, but there is no teaching or suggestion in Shafer of the above-stated recitations of Applicants' independent claims. Official Notice does not compensate for the deficiencies of Shafer et al. in this regard.

Regarding the substantially circular exit pupil of cancelled Claims 4 and 11, now recited in new Claims 20, 32, and 45, the assertion in the rejection under 35 U.S.C. § 102(e), that the catadioptric optical system shown in Fig. 8 of Shafer et al. has an exit pupil on the imaging element (86) which appears to be substantially circular, does not provide an appropriate basis for the rejection. Shafer et al. do not clearly show an exit pupil on the lenses, but in any case, there is a shielding object in the neighborhood of the center of the optical axis based on the openings 37, 47, 117, and 119 at the on-axis position. The specification of the present

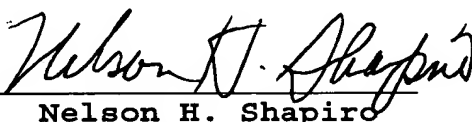
application defines an exit pupil that is substantially circular as an exit pupil in which there is no shielding object in the neighborhood of the center of the optical axis. By this definition, Shafer et al. do not disclose an exit pupil that is substantially circular.

This application is now believed to be clearly in condition for allowance.

The Commissioner is hereby authorized to charge to Deposit Account No. 50-1165 any fees under 37 C.F.R. §§ 1.16 and 1.17 that may be required by this paper and to credit any overpayment to that Account. If any extension of time is required in connection with the filing of this paper and has not been requested separately, such extension is hereby requested.

Respectfully submitted,

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August 20, 2001



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$$0.04 < |fM1| / L < 0.4$$

wherein $fM1$ is a focal length of said concave reflecting surface of said first or second reflecting surface, and L is a distance along the optical axis from said first surface to said second surface.

Further, in the present invention, the following condition is preferably satisfied:

$$0.6 < |\beta M1| < 20$$

wherein $\beta M1$ is a magnification of said concave reflecting surface of said first or second reflecting surface.

Further, in the present invention, the following condition is preferably satisfied:

$$0.3 < |\beta 1| < 1.8$$

wherein $\beta 1$ is a magnification of said first imaging optical system.

Further, the present invention provides a projection exposure apparatus comprising:

an illumination optical system for illuminating a mask on which a predetermined pattern is formed; and
a catadioptric optical system [according to any one of claims 1-7 or 10 to 14] for projecting said predetermined pattern of said mask disposed on said first surface onto a photosensitive substrate disposed on said second surface.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view schematically illustrating the